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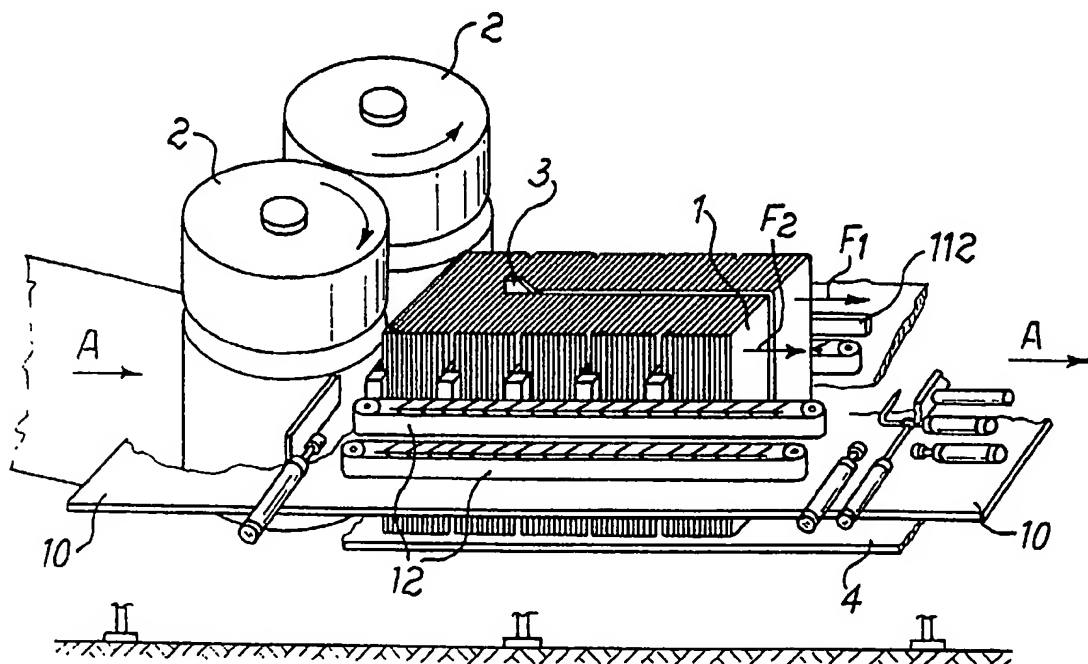
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(54) Title: APPARATUS FOR SEPARATING AND MOVING AWAY FROM EACH OTHER TWO CONSECUTIVE SHEETS MOVABLE IN A FEEDING DIRECTION



(57) Abstract: Apparatus for separating and moving away from each other two independent consecutive sheets (1) movable in a given feeding direction (A), which comprises separating means which are stably arranged in the end-of-travel zone of the outward path (11) and can be actuated by means of associated actuator means (62, 63) for insertion/extraction of the separating finger (31) between/from the two consecutive sheets and relative movement away thereof in the longitudinal direction.

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Apparatus for separating and moving away from each  
other two consecutive sheets movable in a feeding  
direction

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DESCRIPTION

The present invention relates to an apparatus for separating consecutive sheets movable translationwise in a feeding direction and for relative movement away of a sheet from the following sheet in the said feeding  
10 direction.

In the paper technology sector machines for the production of paper serviettes are known, said serviettes being made from a continuous strip which is folded in the longitudinal direction (parallel to the  
15 feeding direction) and is fed to a pair of counter-rotating cylinders provided with means able to produce a fold in the same strip in the transverse direction so as to form a continuous pleated arrangement which is fed, in a guided manner, towards a fixed blade which  
20 cuts the pleated arrangement into two in the longitudinal direction, producing two rows of folded serviettes which are separate from each other and which are fed in a parallel manner along the machine.

It is also known that the two rows of serviettes must  
25 be divided into separate packs, each of which is formed by a precise and specific number of serviettes which must be removed from the forming machine and fed to the wrapping machine for packaging thereof.

In order to be able to count the number of serviettes  
30 forming the individual pack at the exit point from the two cylinders, separate two successive packs from each other and then be able to move the latter away from each other so as to allow entry between them of the means for removal of one pack at a time, it is  
35 envisaged using apparatus based on the use of fingers

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mounted on sliders which are made to slide parallel to the direction of feeding of the serviettes, along a substantially annular path comprising an outward section and return section.

5 At the start of the outward section and immediately downstream of the folding cylinders, devices are provided, which, at the end of said counting of the number of serviettes, operate the slider, pushing it transversely so as to produce insertion of the finger  
10 along the trajectory of the serviettes.

Said fingers from this moment are moved translationwise either by associated conveying means or are drawn along by the serviettes themselves, as far as a predefined position where the fingers, which in reality are formed  
15 by two parts - i.e. one part which is fixed to the slider and one part which is movable rotationally with respect to the first part -, separate and cause the intended separating movement of two successive packs of serviettes, the first of said packs being removed by  
20 the associated gripping devices for unloading thereof. Apparatus of this kind are known, for example, from EP 0,294,675 and WO-9728076.

Although performing their function, these machines have certain drawbacks arising from their particular  
25 constructional design and are formed by a large number of parts which require precise machining and are subject to notable wear due to the relative friction, resulting in high production and assembly costs and machine downtime for the necessary maintenance.

30 In addition to this, the apparatus of the known type have intrinsic limitations as regards the possibility of reducing the minimum number of serviettes per pack to be formed, it not being possible to reduce beyond certain limits the thickness of the fingers in the  
35 feeding direction.

The technical problem which is posed, therefore, is that of providing an apparatus for separating two successive sheets forming part of a plurality of sheets movable translationwise in a predefined feeding direction and for mutually moving away one sheet from the following sheet so as to allow gripping by associated removal means, which apparatus has a high degree of precision, a simple constructional design and is able to reduce both the wear of the moving component parts and the minimum number of sheets per pack which it is able to separate compared to the known apparatus. Within the scope of this problem a further need is that the apparatus should be able to reduce the damage to the sheets at the moment of separation and/or relative movement away of the two sheets of the successive packs and that it should also be applicable to already existing machines with a limited need for special adaptation.

These technical problems are solved according to the present invention by an apparatus for separating and moving away from each other two independent consecutive sheets movable in a given feeding direction, which comprises separating means which are stably arranged in the end-of-travel zone of the outward path and can be actuated by means of associated actuator means for insertion/extraction of a separating finger between/from the two consecutive sheets and relative movement away thereof in the feeding direction.

Further details may be obtained from the following description of a non-limiting example of embodiment of the invention provided with reference to the accompanying drawings in which:

- Figure 1 shows a perspective view of the apparatus arranged downstream of a pair of cylinders for folding paper serviettes;

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- Figure 2 shows a top plan view of the apparatus according to Fig. 1;
  - Figures 3a,3b,3c show top plan views of the detail of the zone for separation of the serviettes during the successive steps of arrival and introduction of the separating finger;
  - Figure 4 shows a cross-section along the plane indicated by IV-IV in Fig. 3c;
  - Figure 5 shows a top plan view of the detail of the zone for the relative movement away of two successive groups of serviettes;
  - Figures 6a,6b,6c show top plan views illustrating the zone of relative separating movement during the associated operating sequence;
  - Figures 6'a,6'b show partial schematic sections along the planes VI'a-VI'a and VI'b-VI'b of Fig. 6a and 6b, respectively;
  - Figure 7 shows a top plan view of the device for moving the slider carrying the said separating finger;
  - Figures 8a-8d show top plan views of the sequence for recovery of the slider carrying the separating finger.
- As illustrated, the apparatus according to the invention is mounted on a machine for folding serviettes 1 which, upon leaving a pair of counter-rotating cylinders 2, form a continuous pleated sheet which advances along a support surface 4 in a feeding direction A towards a fixed blade 3 so as to be cut by the latter in the longitudinal direction into two rows F1 and F2 of folded serviettes which are separate from each other and must be divided into packs P1 ... Pn formed by a specific number of serviettes and then moved away from each other so as to allow the insertion of associated gripping means (not shown) which remove each pack, unloading the forming machine and feeding a packaging machine (not shown).

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Belts 4a are also provided on the surface 4 (Fig. 2) and are designed to promote feeding of the two rows of serviettes in the feeding direction.

The apparatus according to the invention (Fig. 2) comprises a base plate 10 on which a travelway 11, parallel to the direction of feeding "A" of the serviettes 1 (referred to below in short as "longitudinal direction") is defined; the longitudinal edges of the travelway 11 are delimited towards the inside by a fixed guide 10a and towards the outside by a section of a first belt 12 which is endlessly wound onto two rollers 12a, 12b which are motorized by means of suitable transmissions, not shown, which connect said belt to the shaft of an actuating motor M.

A second belt 12 is also mounted on each plate 10, arranged alongside and parallel to the first one, so that the two parallel and facing sections of each belt 12 define as a whole a second travelway 13 which is central and parallel to the first one.

For the sake of simplicity and as will emerge more clearly below, the travelway lying between the belt 12 and the guide 10a forms the outward path, while the travelway 13 between the two belts 12 forms the return path of the sliders 30 each carrying a finger 31 extending in a direction substantially perpendicular to the direction of feeding of the serviettes (referred to below as "transverse direction").

As shown in Fig. 4, the finger 31 has a substantially C-shaped cross-section.

Each belt 12 has, arranged inside it, elastically deformable elements 12c which are able to keep the belt pressed against the slider which, on the opposite side, bears against said longitudinal guide 10a joined to the surface 10 so that the friction between belt and slider causes driving of the latter by the former.

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Figures 1 and 2 also show a possible alternative embodiment of the means for confining the slider 30 along the return path: in this embodiment the second belt 12 which is outermost with respect to the serviettes is replaced by a fixed sidewall 112 against which the slider is kept in contact by the thrusting action of the elastic means 12c located inside the belt 12.

In the initial zone of the outward section (Figs. 3a and 4), which zone is located immediately downstream of the folding cylinders 2, there are provided sliders 30 in a take-up position and means 40, 50 for insertion of the fingers 31 between two consecutive sheets forming the last sheet of a pack Pn being formed and the first sheet of the following pack Pn+1 (Fig. 4).

In greater detail (Figs. 3a-4) said means 40 consist of a cylinder 41 which is fixed to the plate 10 and the rod 41a of which is able to push translationwise each slider 30 in the transverse direction, from the said take-up position (end of the return path 13) into a standby position for insertion between the serviettes, where the said finger 31 is introduced inside a seat 2a of the forming cylinder 2, but outside the trajectory of the serviettes 1 leaving the cylinder itself.

Said standby position is defined by an end-of-travel stop formed by an end section of the guide 10a (Fig. 3a).

The means 50 for inserting the finger 31 between the serviettes consist of a plate-like piece 51 (Fig. 4) which is movable translationwise parallel to the longitudinal direction inside an associated guide slot 51a formed in the plate 10; said plate-like piece 51 is moved upon operation of corresponding actuating means - for example consisting of a cylinder 52 which can be activated by corresponding devices - which are



associated with the cylinders 2 which emit an enable signal at the end of counting the programmed number of serviettes 1 which must form each pack.

At the end of the outward path (Fig. 5), on the other  
5 hand, there are provided the means 60 for relative movement of one pack  $P_n$  away from the following pack  $P_{n+1}$  and the means 70 for picking up the slider 30 from the outward path and insertion thereof along the return path 13 which terminates in turn in the said take-up  
10 zone where the operating cycle described below starts. In greater detail (Fig. 7) the means for moving two successive packs away from each other consist of a pointer 61 arranged in the transverse direction with respect to feeding of the serviettes and connected to a  
15 flange 61a joined to a sliding block 61b sliding in the transverse direction on guides 61c and in the longitudinal direction on guides 61d; said sliding block is moved in the two directions, i.e. transverse direction and longitudinal direction, by associated  
20 rods 62a, 63a of a corresponding number of cylinders 62, 63. Consequently the actuation, in either direction, of the rod 63a causes the pointer 61 to move in a direction parallel to the direction of feeding of the serviettes, while the actuation of the rod 62a in  
25 both directions causes a corresponding translation of the pointer 61 in the direction transverse to the feeding direction.

The means for picking up the slider 30 for extraction thereof from the outward path and insertion into the  
30 return path consist (Fig. 5) of a pair of cylinders 71, 72 which are arranged respectively transversely and parallel to the longitudinal direction of feeding of the serviettes 1.

The rod 71a of the transverse cylinder 71 carries a  
35 magnet 71b which, coming into contact with the slider

30, is attracted to it and during the return stroke draws it back in the transverse direction out from the end of the outward path position into a position aligned with the rod 72a of the cylinder 72, which, emerging from the cylinder, pushes the slider into the return travel path lying between the two facing return sections of the rotating belts 12 (or belt 12 / fixed sidewall 112) which, engaging by means of friction with the opposite surfaces of the slider 30, convey the latter as far as the take-up zone at the end of the return path.

The operating principle of the apparatus is as follows:

- starting from a condition where the sliders 30 are arranged in a row in the take-up zone (Fig. 3a), the cylinder 41 is actuated and pushes a slider 30 in the transverse direction (Fig. 3b), arranging it in the standby position with the finger 31 inserted inside the special channel 2a of the cylinder 2, but outside of the trajectory of the serviettes 1 emerging therefrom;
- once counting has been completed, the control device activates the cylinder 52 which pulls forwards, in the longitudinal direction, the slider 30 so that the finger 31 is inserted into the trajectory of the serviettes 1 between the last serviette (end of count) of a pack P<sub>n</sub> and the following serviette which forms the first one (start of count) of the pack P<sub>n+1</sub> (Figs. 3c, 4).

- from this moment the slider 30 confined in the transverse direction between the contact surface 10a and the belt 12 drives the serviettes 1 which advance, moved also by associated feeder belts 4a inserted in corresponding seats in the surface 4 (Fig. 2).

In this way, during the outward travel, the slider 30 advances, being guided so as to avoid jamming and the like, also helping keep the pack of serviettes 1

properly aligned;

- when the end of the outward path is reached (Figs. 5, 6a), the slider 30 is picked up by a magnetic element 35a mounted on the rod 35b of a cylinder 35 fixed to the surface 10 and brought into contact with a mechanical end-of-travel stop 36; once in contact with the end-of-travel stop, a suitable sensor signals the presence of the slider 30, activating the cylinder 62 which pushes forwards, in a transverse direction, the cylinder 63 and therefore the pointer 61 (Figs. 6a, 6'a) which, having reached the transverse end-of-travel position, detected by suitable sensors, activates the stroke of the piston 63 which moves the pointer 61 forwards with respect to the finger 31, which is at a standstill, causing separation of the two successive packs;

- when there is no longer the need for separation (Figs. 8a-8d), i.e. the pack has been removed by the gripping means for unloading, the cylinder 71 is activated and, by extracting its rod 71a, brings the magnet 71b into contact with the slider 30 which is attracted to the said rod and follows it along the return path (Fig. 8b), thus bringing the slider into a position aligned with the return path and in contact with a tappet 10b which retains the slider while the rod 71a continues its stroke, being separated from the said slider;

- the cylinder 72 is activated and, extracting its rod 72a, pushes the slider 30 into the return travelway 13 between the two facing belts 12 which push the slider towards the pick-up zone ready for a new cycle.

It is therefore obvious from the above description how the element which produces the relative separating movement of two successive sheets is positioned in the zone where the said relative movement actually occurs

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and is not instead continuously moving together with the slider 30, thus avoiding the need for complex machining of small-size parts and wear due to the continuous movement along the annular path.

- 5 In addition to this, the fact that the element for the mutual separating movement is able to be inserted into the thickness of the finger which separates two consecutive sheets, by which it is guided, results in a reduction in the overall dimensions in the longitudinal
- 10 direction, allowing a reduction in the minimum number of serviettes which form the pack to be separated, but ensuring at the same time a high degree of reliability and repeatability in terms of operation and less likelihood of damage to the serviettes themselves.

CLAIMS

- 1) Apparatus for separating sheets (1) movable translationwise in a given feeding direction (A) and for moving away from each other two independent consecutive sheets, which comprises:
- an outward path (11) and a return path (13) which are parallel to the feeding direction;
  - at least one longitudinal side of which paths is formed by driving means (12);
  - separating means comprising at least one slider (30) provided with a finger (31) projecting from the said slider in a direction substantially transverse to the feeding direction;
  - 15 - said slider (30) being movable
    - along the outward path (11) from a start-of-cycle position, for insertion between two consecutive sheets (1), to an end-of-travel position for movement of two consecutive sheets away from each other in the feeding direction;
    - 20 · along the return path (13), from the said end-of-travel position to said start-of-cycle position;
    - first means (40,50) for actuating the slider (30), arranged in the start-of-cycle zone, for insertion of the finger between two consecutive sheets;
    - 25 - means (60,61) for moving two consecutive sheets away from each other;
    - second means (70) for picking up the slider (30) from the end-of-travel position of the outward path (11) and insertion of the slider in the return path;
    - 30 characterized in that:  
said means (60,61) for the relative separating movement of two consecutive sheet are stably arranged in the end-of-travel zone of the outward path (11) and can be  
35 actuated by means of associated actuator means (62,63)

for insertion/extraction of the separating finger (31) between/from the two consecutive sheets and the relative movement away thereof in the feeding direction.

5

2) Apparatus according to Claim 1, characterized in that said means (61) for moving two consecutive sheets away from each other perform linear movements.

10

3) Apparatus according to Claim 2, characterized in that said means (61) effecting the separating movement perform a translatory movement in the direction transverse to the feeding direction for insertion of the separating finger (31) between two consecutive

15

4) Apparatus according to Claim 2, characterized in that said means (61) effecting the separating movement perform a translatory movement in a direction parallel to the feeding direction for relative movement away of two consecutive sheets ( $P_n, P_{n+1}$ ).

20

5) Apparatus according to Claim 1, characterized in that said means effecting the mutual separating movement consist of a rectilinear element.

25

6) Apparatus according to Claim 1, characterized in that said separating finger (31) joined to the slider (30) has a C-shaped cross-section.

30

7) Apparatus according to Claim 5, characterized in that said means (61) effecting the separating movement have a thickness less than the thickness of the separating finger (31).

35

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8) Apparatus according to Claim 1, characterized in that said means (62,63) for actuating the separating means (61) are of the linear type.

5 9) Apparatus according to Claim 8, characterized in that said actuating means (62,63) comprise elements producing a thrust in the transverse direction and elements producing a thrust in the longitudinal direction.

10

10) Apparatus according to Claim 8, characterized in that said elements producing a thrust in the transverse direction consist of a cylinder (62,62a).

15 11) Apparatus according to Claim 8, characterized in that said means producing a thrust in the longitudinal direction consist of a cylinder (72,72a).

20 12) Apparatus according to Claim 1, characterized in that said insertion means are associated with an enabling sensor connected to the sheet counting devices.

25 13) Apparatus according to Claim 1, characterized in that said first means (40,50) for insertion of the finger (31) along the trajectory of two consecutive sheets are of the linear type.

30 14) Apparatus according to Claim 13, characterized in that said first insertion means (40,50) comprise elements (41,41a) producing a thrust in the transverse direction and elements (51,52) producing a thrust in the longitudinal direction.

35 15) Apparatus according to Claim 14, characterized in

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that said elements producing a thrust in the transverse direction consist of a cylinder (41,41a).

- 5 16) Apparatus according to Claim 14, characterized in that said means producing a thrust in the longitudinal direction consist of a flat piece (51) movable on an associated longitudinal guide (51a) of the fixed support plate (10).
- 10 17) Apparatus according to Claim 1, characterized in that said insertion means (40,50) are associated with enabling means associated with the sheet counting devices.
- 15 18) Apparatus according to Claim 1, characterized in that said second means (71,72) for recovery of the sliders (30) from the end-of-travel zone of the outward path (11) are of the linear type.
- 20 19) Apparatus according to Claim 18, characterized in that said second means (71, 72) comprise elements (71, 71a, 71b) performing driving in the transverse direction and elements (72, 72a) producing a thrust in the longitudinal direction.
- 25 20) Apparatus according to Claim 19, characterized in that said elements performing driving in the transverse direction consist of a cylinder (71, 71a).
- 30 21) Apparatus according to Claim 20, characterized in that a magnet (71b) is attached to the free end of the rod (71a) of the cylinder (71).
- 35 22) Apparatus according to Claim 18, characterized in that said means producing a thrust in the longitudinal



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direction consist of a cylinder (72, 72a).

23) Apparatus according to Claim 1, characterized in that said apparatus is arranged on a support surface  
5 (10).

24) Apparatus according to Claim 23, characterized in that said support surface is separate from the surface  
10 (4) for feeding of the sheets (1).

25) Apparatus according to Claim 1, characterized in that said outward path (11) of the sliders (30) is delimited in the transverse direction by a guide (10a) joined to the surface (10) and by a belt section (12).  
15

26) Apparatus according to Claim 1, characterized in that said return path of the slider (30) is delimited in the transverse direction by a belt section (12) and by a fixed sidewall (112).  
20

27) Apparatus according to Claim 1, characterized in that elastic means (12a) for producing a thrust in the transverse direction are arranged inside said outward and return belt(s) (12).  
25

28) Apparatus according to Claim 1, characterized in that it comprises means for picking up the slider (30) which are arranged in the end-of-travel zone of the outward path of the said slider and are able to move  
30 the latter in the feeding direction from the exit of the outward path to an end-of-travel stop (36).

29) Apparatus according to Claim 28, characterized in that said gripping means are formed by a cylinder (35).  
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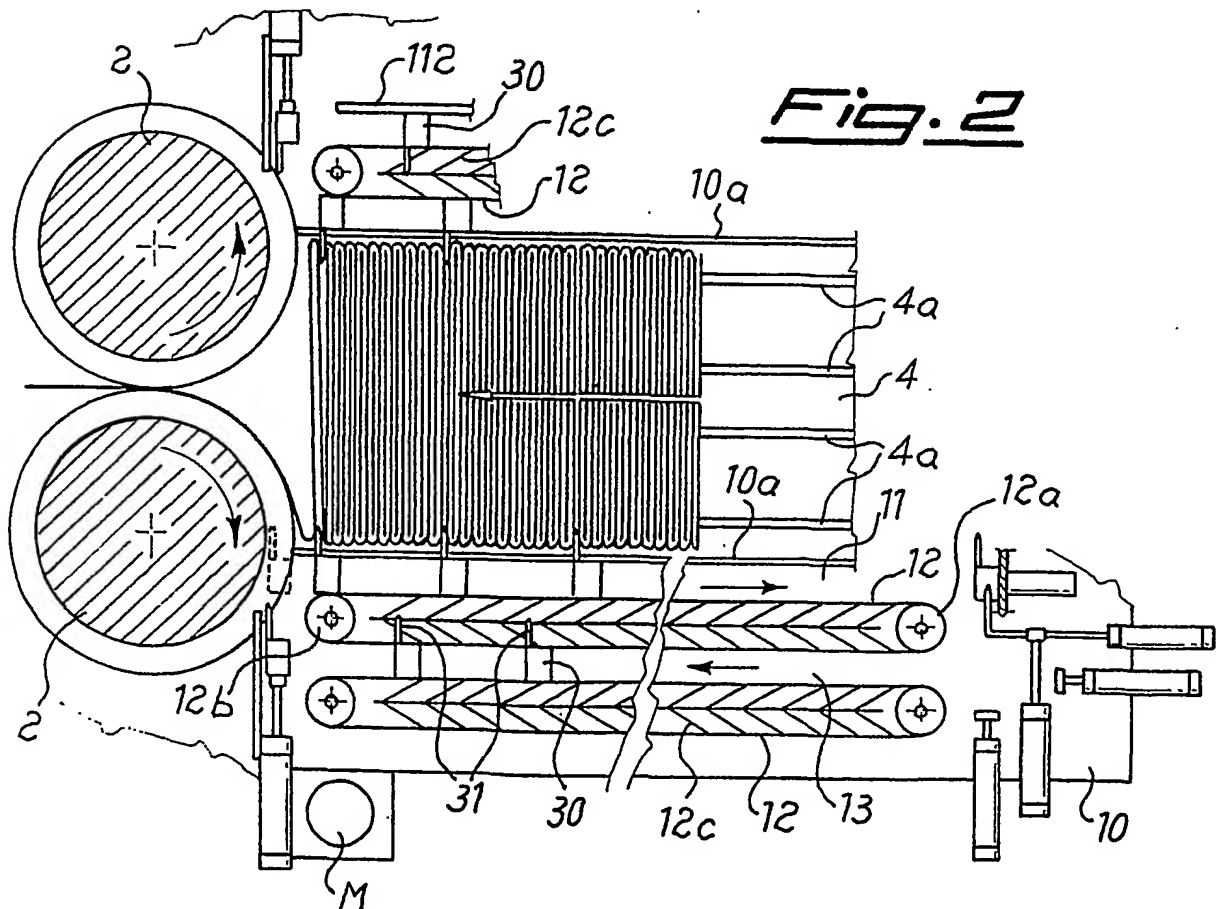
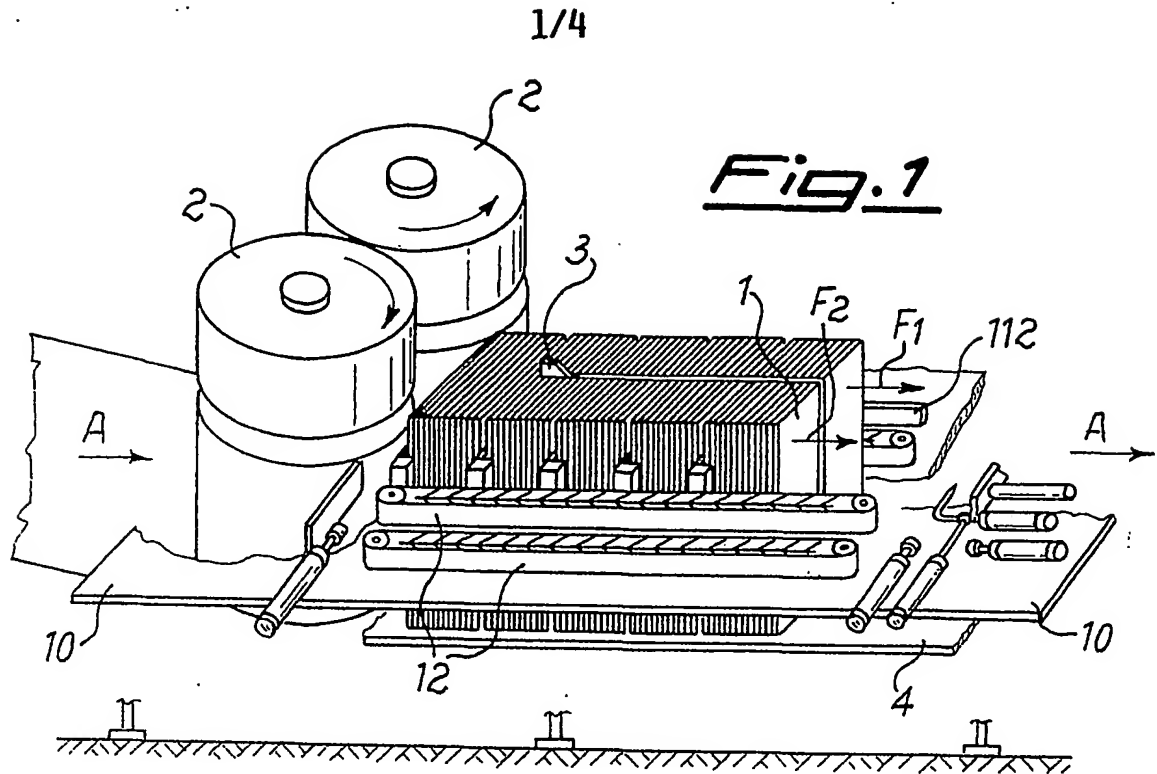
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30) Apparatus according to Claim 29, characterized in that an element for gripping the slider (30) is mounted on the free end of the rod (35b) of said cylinder (35).

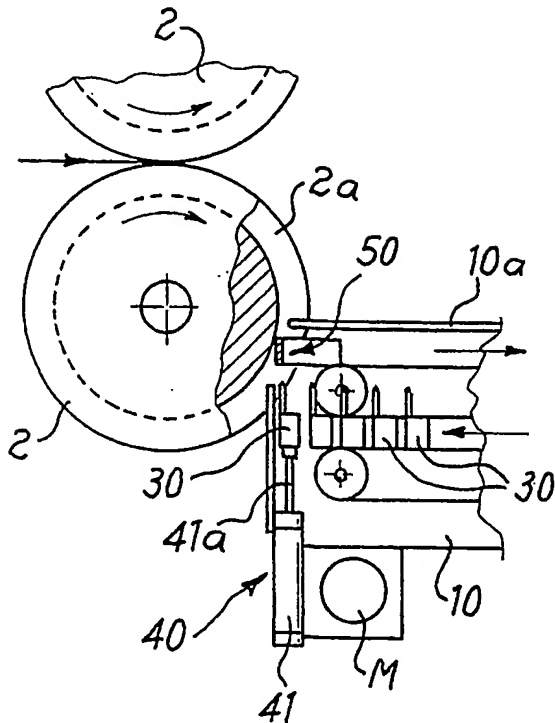
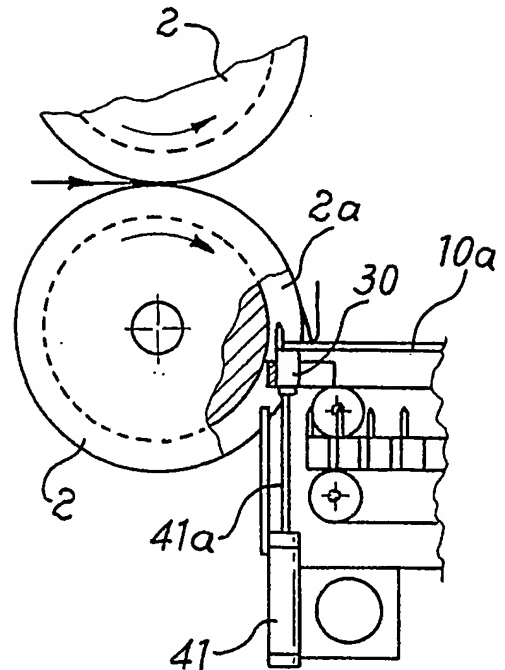
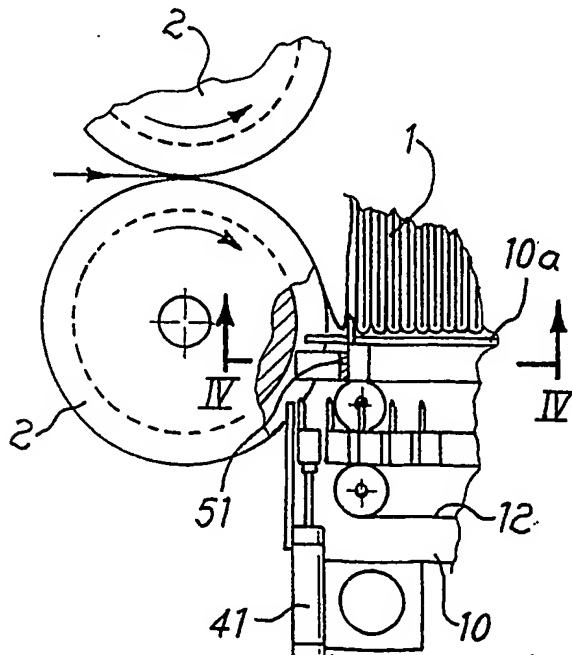
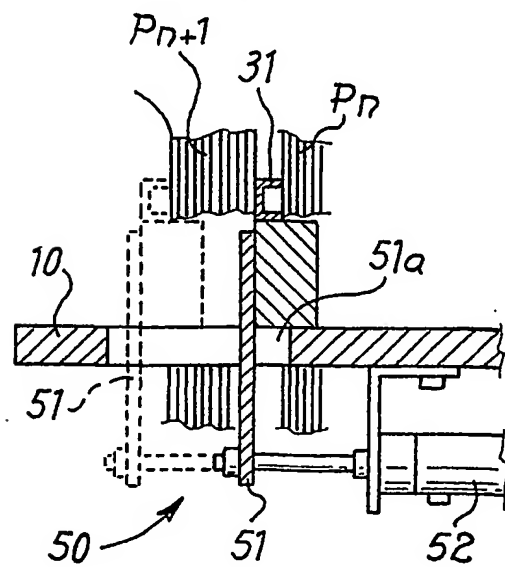
5 31) Apparatus according to Claim 30, characterized in that said gripping element is of the magnetic type.

32) Machine for forming and folding sheets movable in a feeding direction (A), characterized in that it  
10 comprises at least one apparatus according to Claim 1 for separating and moving two consecutive sheets away from each other in the said feeding direction (A).

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Fig. 3aFig. 3bFig. 3cFig. 4

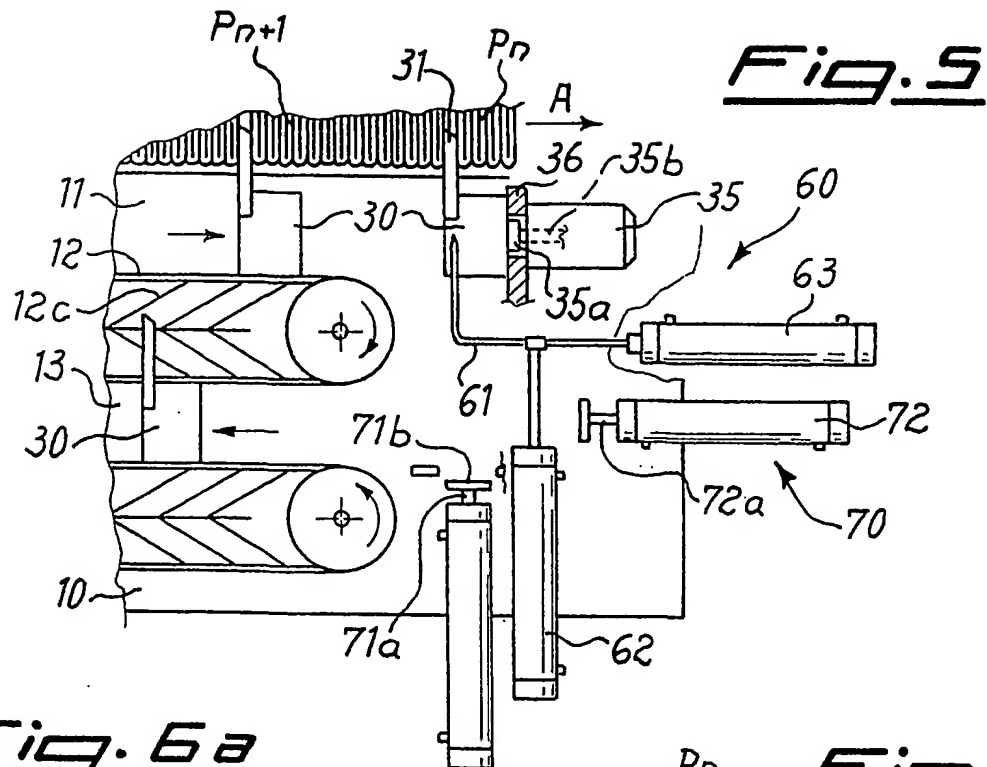


Fig. 6a

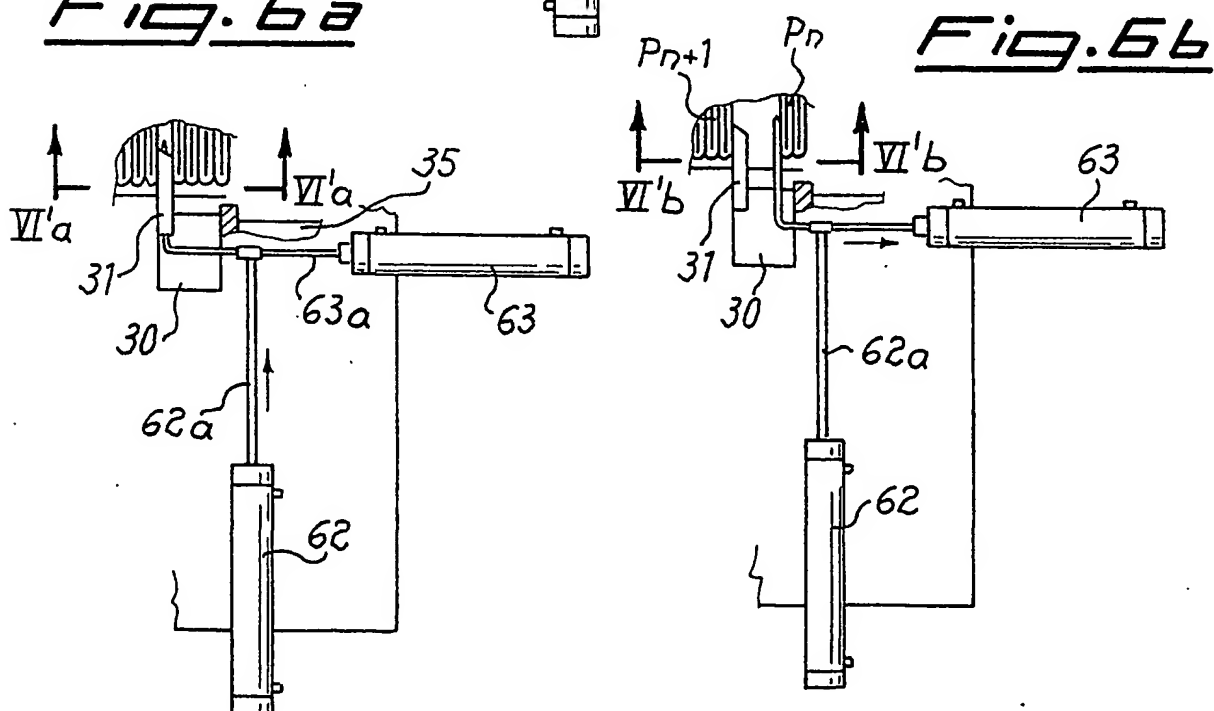


Fig. 66

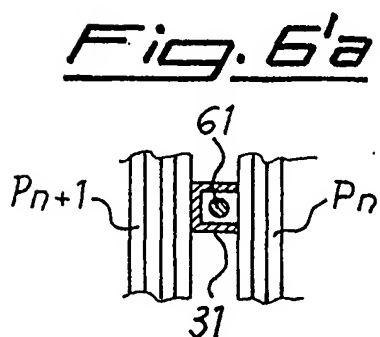


Fig. 6'a

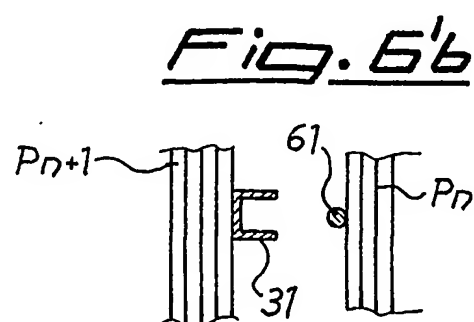
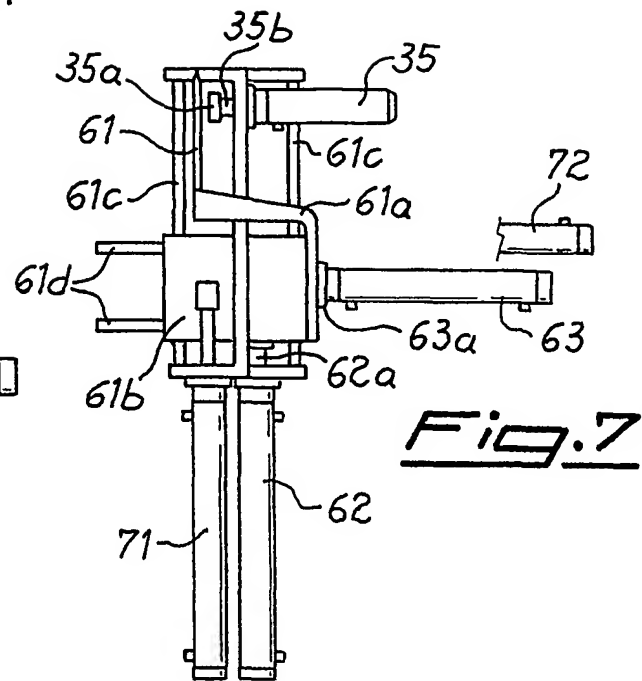
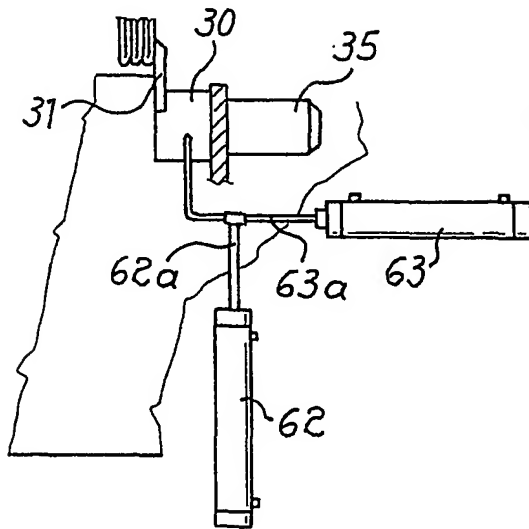
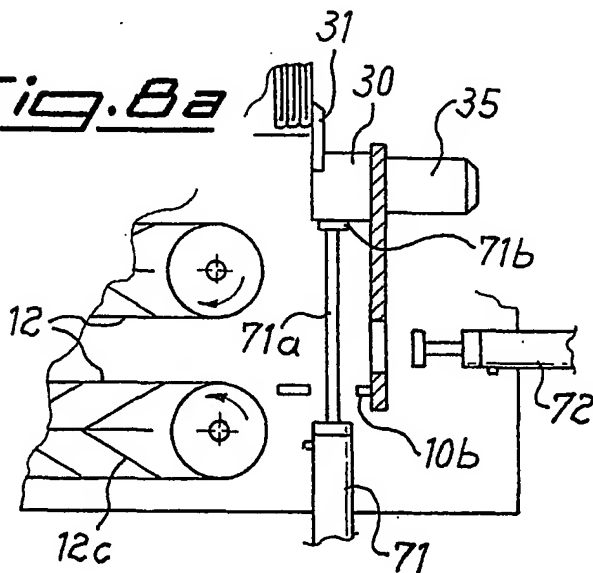
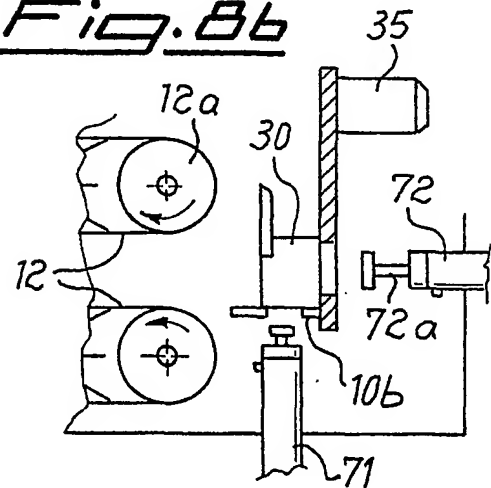
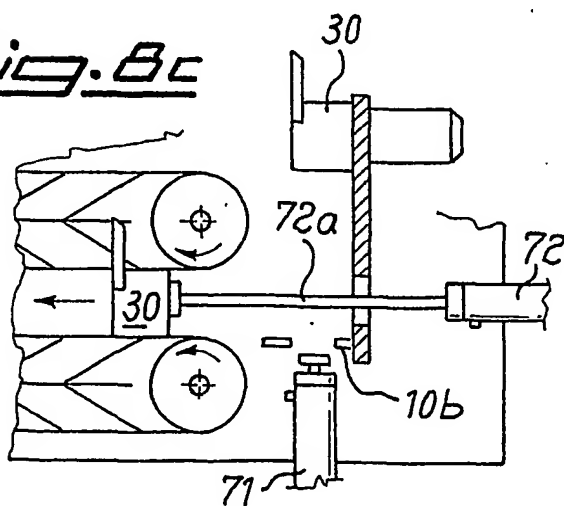
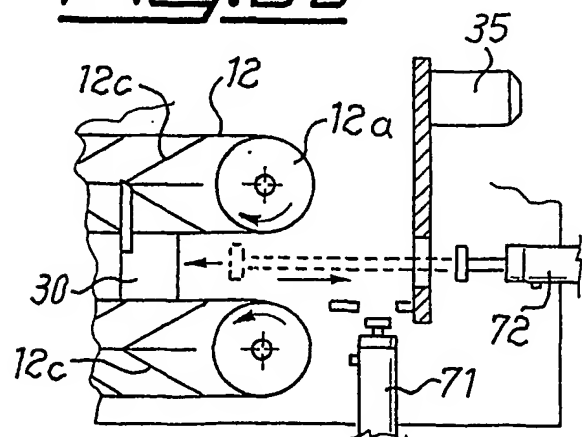


Fig. 6'b

Fig. 6cFig. 8aFig. 8bFig. 8cFig. 8d

## INTERNATIONAL SEARCH REPORT

International Application No  
PCT/EP 01/08579A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 B65H33/18 B65H45/20 B65H33/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 294 675 A (OMET SRL) 14 December 1988 (1988-12-14) cited in the application  column 3, line 53 -column 4, line 54 column 6, line 32 -column 7, line 4; figures	1,2,4,5, 8,11-15, 17,18, 23,32
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Further documents are listed in the continuation of box C.



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Date of the actual completion of the international search

8 January 2002

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## INTERNATIONAL SEARCH REPORT

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